Top Secret

[redacted]

DIRECTORATE OF
INTELLIGENCE

Declass Review by
NIMA / DoD

Imagery Analysis Report

Zaporozhye Titanium and Magnesium Plant, USSR

25X1

[redacted]

Top Secret

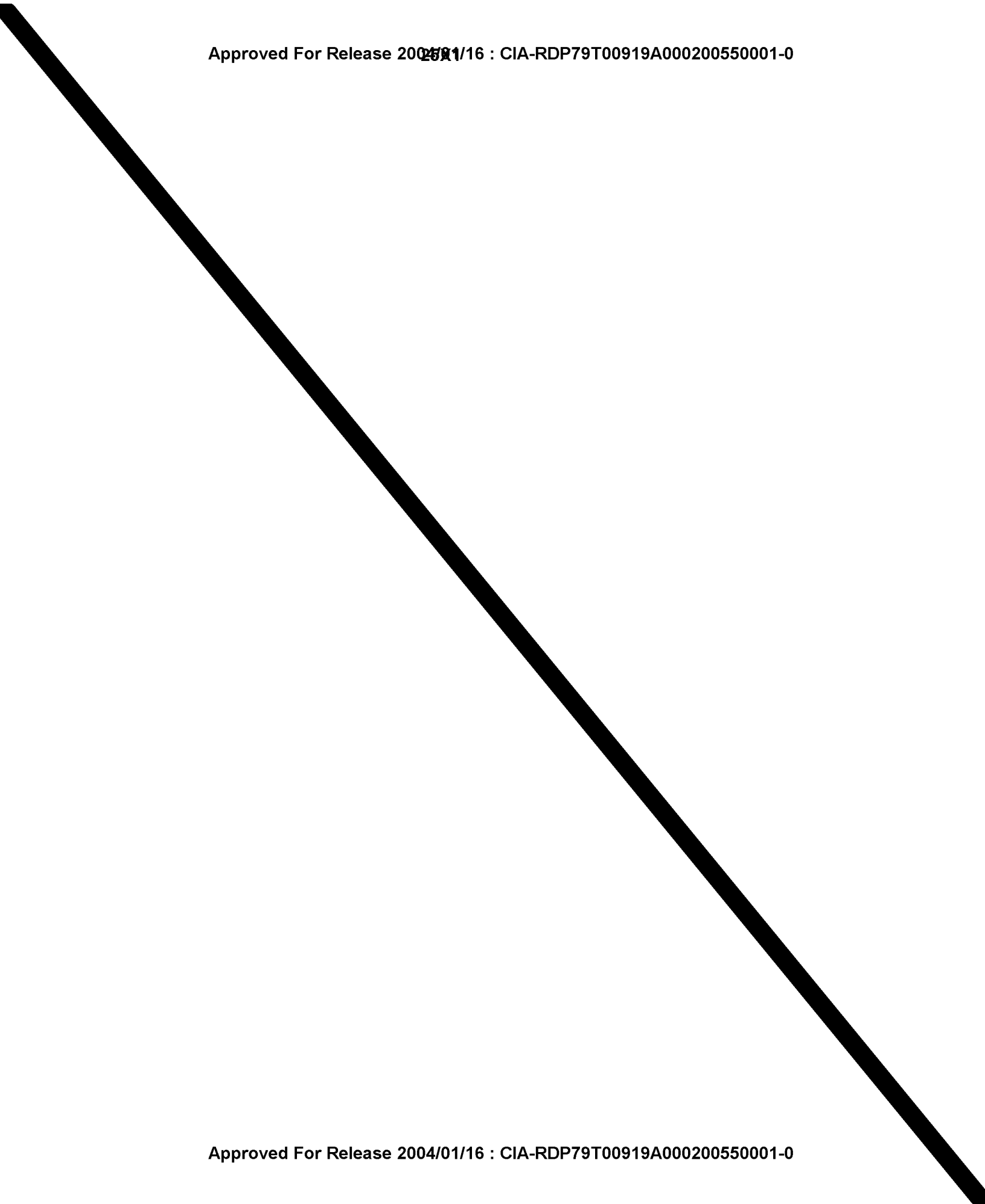
DDI/IAR 85033

[redacted] 25X1

DATE JANUARY 1968

COPY 45

PAGES 11



IMAGERY ANALYSIS SERVICE

January 1968

ZAPOROZHYE TITANIUM AND MAGNESIUM PLANT
USSR

SUMMARY

The Zaporozhye Titanium and Magnesium Plant is the first of the three known Soviet Titanium plants to begin titanium metal production. All of its major production components, except two of the probable magnesium electrolytic cell buildings, were operating when the plant was first seen [redacted] The remaining two buildings were seen active [redacted] and the plant has been in continuous operation since. The facilities tentatively identified include a Kroll reduction building for titanium production and three electrolytic cell buildings for magnesium production.

CONTENTS

Illustrations

25X1

25X1

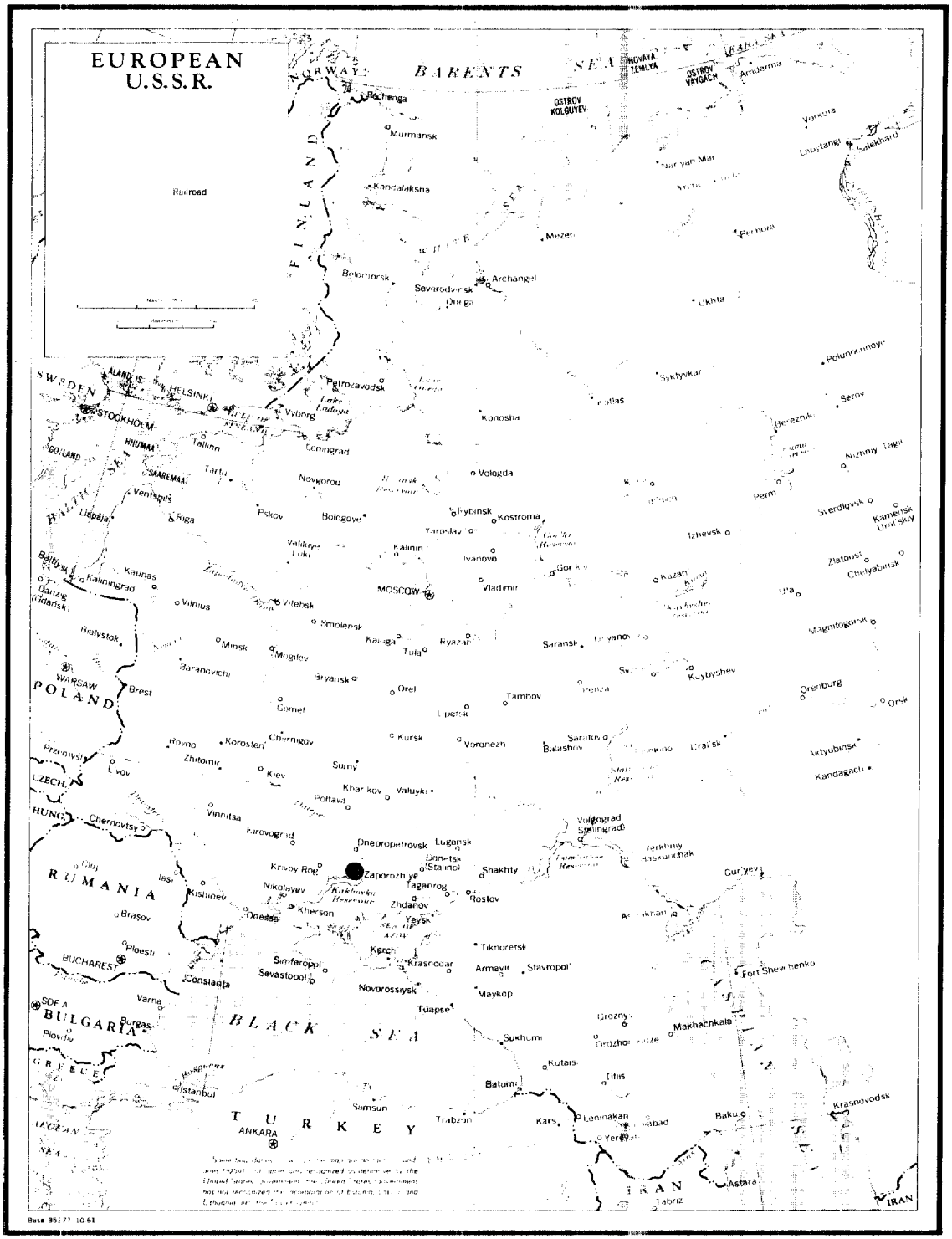


FIGURE 1. LOCATION MAP

INTRODUCTION

The Zaporozhye Titanium and Magnesium Plant [redacted] Dneprovskiy is located on the north edge of Zaporozhye, USSR, at 47-53N 035-12E (Figure 1). 25X1

This plant was studied using all available photographic coverage [redacted] 25X1
25X1 [redacted] The purpose of the report is to identify, measure, and provide a chronological analysis of the facilities at this plant. Building identifications
25X1 [redacted] 1-3/ Many of the facilities are tentatively identified because the configuration of a titanium plant is not limited to a distinctive design.

An unidentified industry located adjacent to the titanium and magnesium plant was delineated as an area for plant expansion [redacted] 25X1
25X1 [redacted] 4/ This industry was erected [redacted] is associated with the titanium and magnesium plant. The functions of the buildings within the area cannot be identified; however, the industry may be using titanium tetrachloride to produce titanium dioxide used as a white pigment in paints, lacquers, plastics, and other products. This industry is not discussed in this report.

25X1 [redacted]

25X1

FIGURE 2. ZAPOROZHYE TITANIUM AND MAGNESIUM PLANT.

DISCUSSION

This plant is wall secured, rail and road served, and occupies an irregularly shaped area of approximately 350 acres. The facilities that are identified include: a probable titanium tetrachloride building, a probable Kroll reduction building, a probable titanium electroslag melting furnace building, three probable magnesium electrolytic cell buildings, two probable chlorine electrolytic cell buildings, a probable air separation plant, a rolling mill, a steam plant, three laboratories, a transformer substation, five administration buildings, and numerous support/storage buildings. Descriptions and dimensions of the major structures are listed on Figure 4. All production facilities, except two of the probable magnesium electrolytic cell buildings, were first seen in operation on the 25X1 [redacted] The two probable magnesium electrolytic cell buildings (Items 24 and 26) were first observed in operation [redacted] 25X1
25X1 [redacted] The following discussion of each of the main production components describes the flow of materials through the plant.

Probable Titanium Tetrachloride Building

This building (Item 22) probably receives a titanium-ore concentrate which is combined with coke and chlorine gas in an exothermic reaction to produce gaseous titanium tetrachloride and carbon dioxide. The gaseous titanium tetrachloride and the chlorinated vapors of associated impurities are condensed and separated by fractional distillation. The pure liquid titanium tetrachloride is then pumped through a pipeline to the probable Kroll reduction building.

Probable Kroll Reduction Building

In the probable Kroll reduction building (Item 7), titanium tetrachloride and magnesium metal combine in an exothermic reaction to produce titanium sponge and magnesium chloride. This reaction takes place in an atmosphere of argon gas to prevent hydrogen and oxygen contamination. The magnesium chloride is tapped off and sent to a probable magnesium electrolytic cell building (Item 23). The titanium sponge remains in the crucible until it has cooled to room temperature. Once cooled, the sponge hardens and must be drilled from the crucible. This operation is extremely dusty and is probably done in the dust covered section (Item 14) on the northeast end of the probable electroslag melting furnace building.

25X1

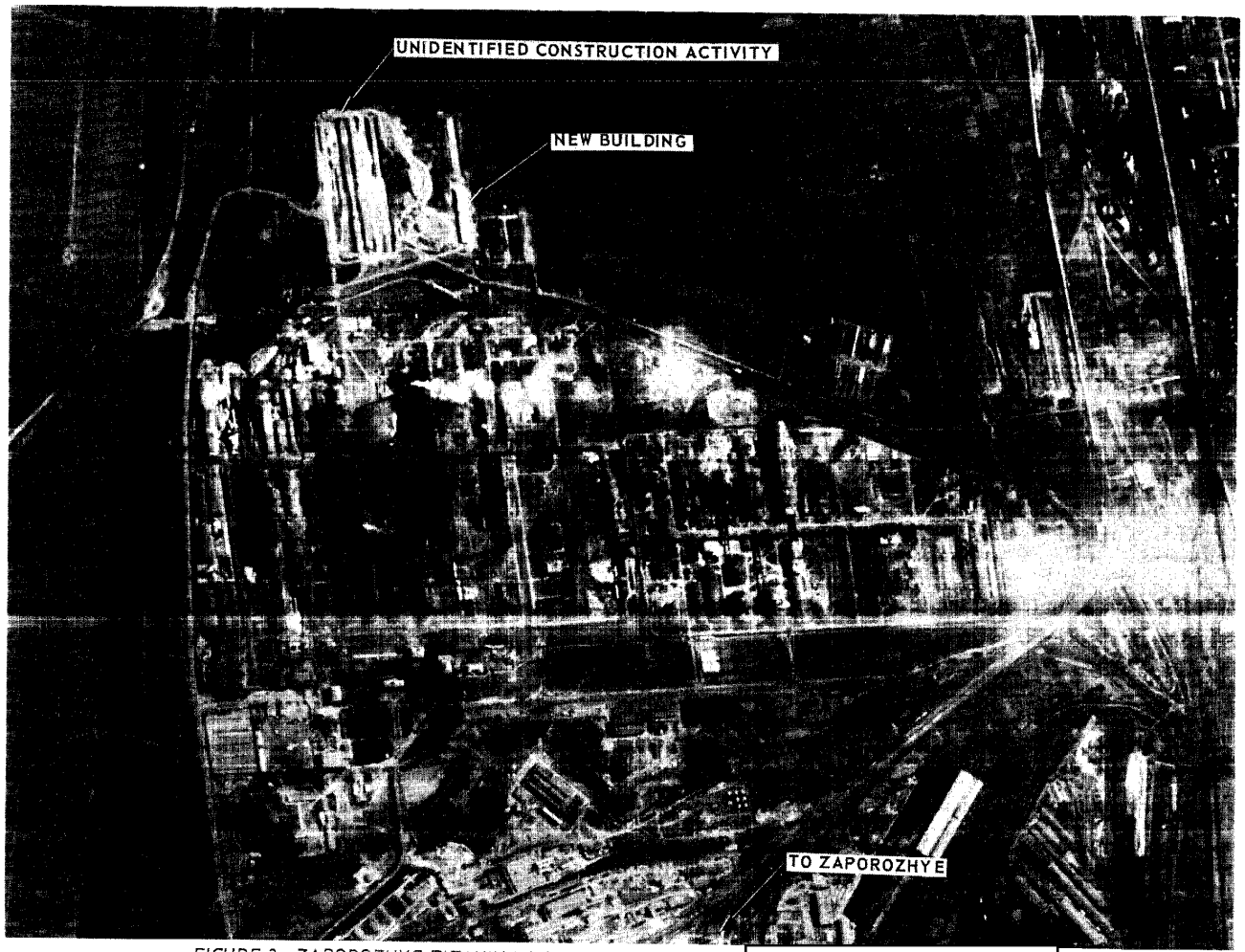


FIGURE 3. ZAPOROZHYE TITANIUM AND MAGNESIUM PLANT

TOP SECRET

IMAGERY ANALYSIS SERVICE

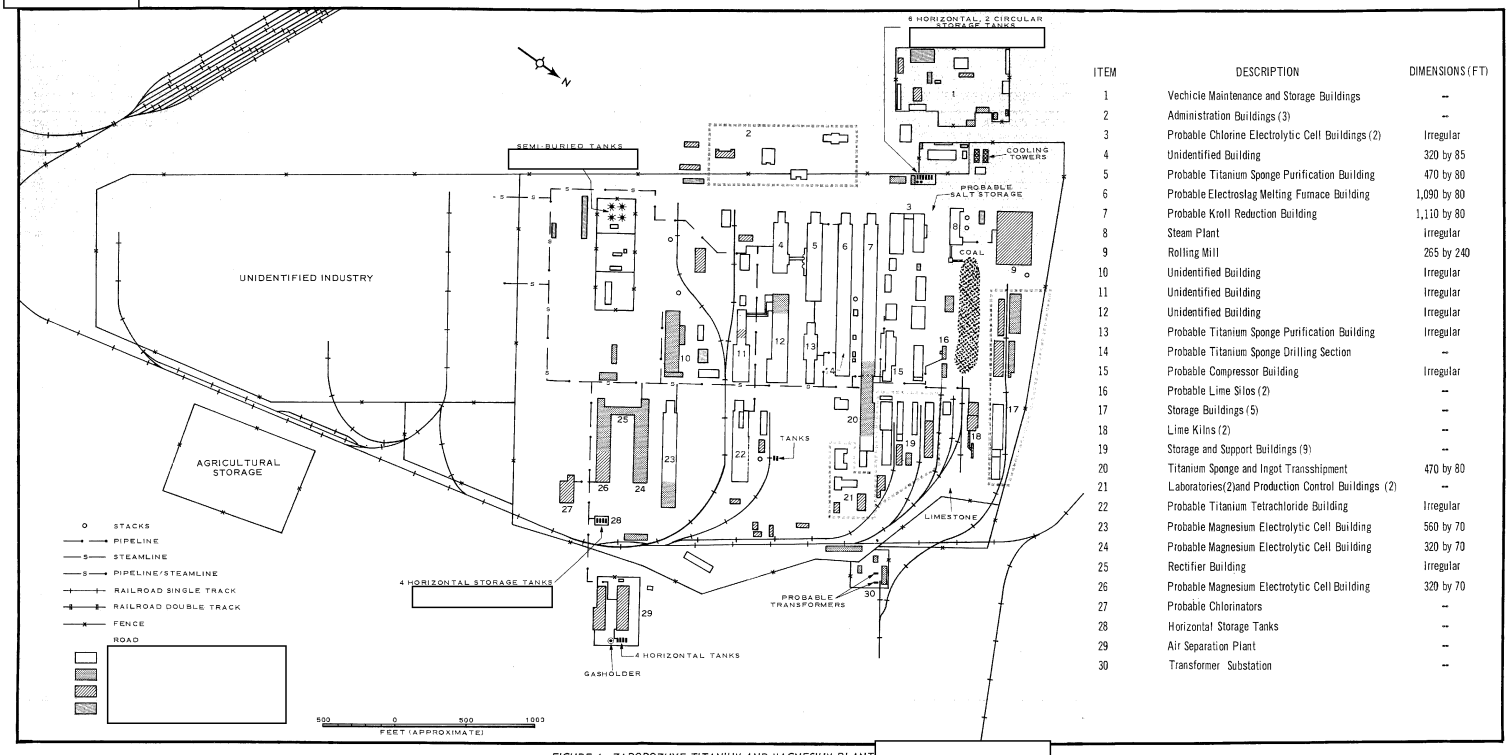
TOP SECRET

25X1

25X1

25X1

25X1



ITEM	DESCRIPTION	DIMENSIONS (FT)
1	Vechicle Maintenance and Storage Buildings	--
2	Administration Buildings (3)	--
3	Probable Chlorine Electrolytic Cell Buildings (2)	Irregular
4	Unidentified Building	320 by 85
5	Probable Titanium Sponge Purification Building	470 by 80
6	Probable Electroslag Melting Furnace Building	1,090 by 80
7	Probable Kroll Reduction Building	1,110 by 80
8	Steam Plant	Irregular
9	Rolling Mill	265 by 240
10	Unidentified Building	Irregular
11	Unidentified Building	Irregular
12	Unidentified Building	Irregular
13	Probable Titanium Sponge Purification Building	Irregular
14	Probable Titanium Sponge Drilling Section	--
15	Probable Compressor Building	Irregular
16	Probable Lime Silos (2)	--
17	Storage Buildings (5)	--
18	Lime Kilns (2)	--
19	Storage and Support Buildings (9)	--
20	Titanium Sponge and Ingot Transshipment	470 by 80
21	Laboratories(2)and Production Control Buildings (2)	--
22	Probable Titanium Tetrachloride Building	Irregular
23	Probable Magnesium Electrolytic Cell Building	560 by 70
24	Probable Magnesium Electrolytic Cell Building	320 by 70
25	Rectifier Building	Irregular
26	Probable Magnesium Electrotytic Cell Building	320 by 70
27	Probable Chlorinators	--
28	Horizontal Storage Tanks	--
29	Air Separation Plant	--
30	Transformer Substation	--

FIGURE 4. ZAPOROZHYE TITANIUM AND MAGNESIUM PLANT

25X1
25X1
25X1

After the drilling is complete, the resulting impure titanium sponge is transported to the adjacent building (Item 13) where the sponge is probably leached with acid for initial purification. The final purification is probably accomplished in Building 5 where the sponge is heated to drive off the last traces of magnesium metal and magnesium chloride. The sponge is then washed and dried before being sent to electroslag melting furnaces.

Probable Electroslag Melting Furnace Building

In order for the titanium sponge to be used in electroslag melting furnaces, it must first be compressed into consumable electrodes, usually with a drop forge. Although no specific indications of a drop forge can be discerned in the probable electroslag melting furnace building (Item 6), the building is high enough and has sufficient space in the southwest end to house such a forge.

In this process the consumable titanium sponge electrodes are converted into titanium metal ingots by melting in an electroslag melting furnace. The ingots are probably stored for shipping in the northeast end (Item 23) of the probable Kroll reduction building. Some of the ingots may be rolled into plates, sheets, or other shapes in the rolling mill (Item 9) on the northwest edge of the combine.

Because there is danger of explosion at electroslag melting furnace buildings, safety precautions are usually taken. The precautions taken at this plant may be a type of blast-deflecting device contained within the six protrusions on the exterior walls of the probable electroslag melting furnace building. [redacted] 25X1

Probable Magnesium Electrolytic Cell Buildings

When this combine was first seen [redacted] it contained only one probable magnesium electrolytic cell building (Item 23). [redacted] two additional probable magnesium electrolytic cell buildings (Items 24 and 26) and their rectifier building (Item 25) had been completed. The [redacted]

25X1
25X1

ILLEGIB

25X1

The other two probable magnesium electrolytic cell buildings produce primary magnesium metal. Magnesia is probably stored in the northeast end of Building 26 where it is pelleted with peat moss, petroleum coke, and magnesium chloride. The pellets are charged into chlorinators (probably contained in Building 27) and heated in the presence of chlorine. The resulting magnesium chloride is then fed to the electrolytic cells where it is separated into magnesium and chlorine.

Probable Chlorine Electrolytic Cell Buildings

As has already been discussed, chlorine is used in this plant to produce titanium tetrachloride and magnesium chloride. The large amounts of chlorine needed for these processes are probably produced in two electrolytic cell buildings (Item 3) located on the west side of the combine. Possible salt-storage piles were seen near these buildings. Salt is the primary raw material needed to produce chlorine. The rectifier section of the building is the small portion in the center, forming the "U" shape of the building.

Other Facilities

Other facilities within the plant area include three administration buildings, two laboratories, two production control buildings, two lime kilns, two probable lime silos, a probable compressor building, a rolling mill, a steam plant, four unidentified buildings, four vehicle maintenance buildings, and numerous support and storage buildings. There are also twelve horizontal, two circular, and four semiburied storage tanks. An air separation plant (Item 29), which provides argon to the probable Kroll reduction building, is located on the east side of the plant. Electric power is supplied through the transformer substation located on the northeast side of the plant (Item 30).

An area of unidentified construction activity, located between the air separation plant and the transformer substation (Figure 2), was first seen on [redacted] photography [redacted] only one building had been constructed.

REFERENCES

Maps and Charts

USAF, 2nd RTS. US Air Target Chart, Series 200. Scale 1:200,000, 4th Edition, December 1963 (SECRET)

Documents

2. CIA. Assignment of High Priority to the Soviet Titanium Industry, April 1960 (SECRET)

3. Carmichael, R. L., "Non ferrous Metals and the Chemical Engineer, Part I: Titanium," Chemical Engineering, November 21, 1966, page 109 (UNCLASSIFIED)

4. CIA. Dneprovskiy Titanium-Magnesium Factory, May 1961 (SECRET

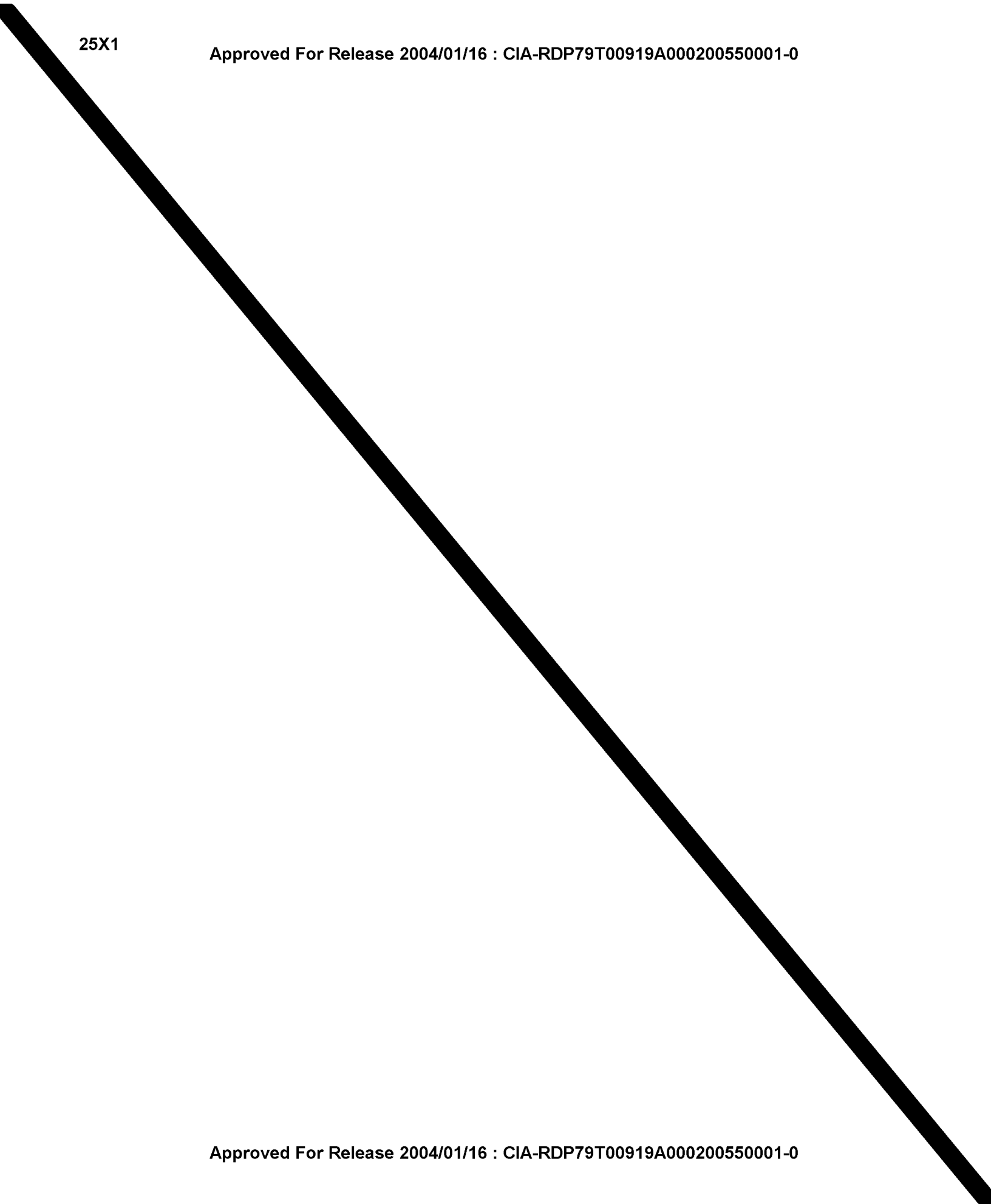
5. CIA. Ust-Kamenagorsk Titanium-Magnesium Combine, November 1967 (TOP SECRET

Requirement

C-RR6-83,290

IAS Project

30746-6



Approved For Release 2004/01/16 : CIA-RDP79T00919A000200550001-0